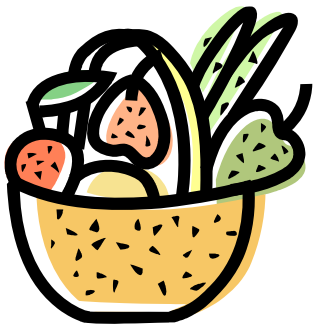
The Benefits of Adequate Fruit and Vegetable Intake: An Annotated Bibliography



Massachusetts Fruit & Vegetable Nutrition Council

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Background

The Benefits of Fruit and Vegetable Intake: an Annotated Bibliography was developed to help raise awareness of the important role of fruits and vegetables in promoting health and in preventing many chronic diseases. This tool is part of the Massachusetts Fruit & Vegetable Nutrition Council's (MF&VNC) efforts to give community based providers up to date information on evidence-based research on the benefits of fruit and vegetable consumption and its relationship to health. The publication of the annotated bibliography coincides with the MF&VNC efforts to promote the new national theme "Fruits and Vegetables—More Matters"™ which was developed by the Produce for Better Health Foundation (PBH) and the Centers for Disease Control and Prevention (CDC) to encourage Americans to eat more fruits and vegetables. For more background information on the Massachusetts Fruit & Vegetable Nutrition Council's (MF&VNC) mission and vision, please refer to Appendix C.

The information provided in **The Benefits of Fruit and Vegetable Intake: an Annotated Bibliography** can be used by community based providers who are interested in developing policies and programs to promote consumption of fruits and vegetables. With the wealth of information available in the realm of nutrition and dietetics, it is especially important for practitioners to have an easy, reliable source of evidence-based research to support their claims. This annotated bibliography provides practitioners with a compilation of scientific studies that examine the relationship between fruit and vegetable intake and health. Practitioners should use the literature presented in this tool as evidence and justification for future endeavors.

The Evidence-Based Process

The evidence-based process is a series of steps that helps practitioners critically evaluate scientific literature. The goal of the process is to sort through the massive amount of information in the field of nutrition and dietetics and identify the best available scientific literature for a particular purpose.

The fruit and vegetable studies in this annotated bibliography were evaluated according to the evidence-based process. Each study was assigned a rating based on epidemiologic criteria outlined by the following textbook: Ann Achengrau, George Seage. Essentials of Epidemiology in Public Health. *Jones and Bartlett Publishers*, April 1 2003. Ratings were based on two grades; a letter grade and a sign grade. The letter grade identifies the type of study design used and the sign grade represents the quality of the study. Letter grades range from A to D; a grade of A represents the best type of study. Some study designs were more prone to bias than others, and were therefore assigned a lower grade rating. An explanation of the rating criteria can be found on the following page.

Each study was critically assessed based on strength and consistency of the statistical analysis, presence of bias and confounding factors, and generalizability of the results. Statistical stability, measured by P values and confidence intervals, was reported for each study. The term "statistically significant" was used to denote that the results obtained have a 95% possibility of being true or very close to the true values. Bias and confounding factors refer to certain characteristics of the study that may have produced an over- or under-estimation of association measures in the study results. Studies were also analyzed to determine whether the study results are generalizable; that is, the results can be applied to populations beyond the study subjects. A plus (+) sign was assigned if all of these issues have been adequately addressed, a minus (-) sign if some of these issues have not been adequately addressed, and a ∅ sign if the study is neither exceptionally weak nor exceptionally strong. (Table 1)

The specific studies in this bibliography were chosen based on availability, topic, strength, and presence of sufficient literature. A number of other sources are also listed for additional reading.

Acknowledgements:
We would like to thank Afaf H. Saab, Laura Thompson and Carol Chan, Nutrition graduate students at Boston University Sargent College of Allied Health for compiling the evidence-based review. Thank you to reviewers: Maria Bettencourt, MPH and Cynthia Taft Bayerl, MS, RD, LDN from the Nutrition and Physical Activity at the Massachusetts Department of Public Health, members of the Massachusetts Fruit and Vegetable Nutrition Council and to Kay Howarter from the American Dietetic Association.

Table 1

American Dietetic Association
Rating Criteria for Evidence Reports

Classes of Evidence Reports

Primary Reports		Secondary Reports	
A	Randomized controlled trial (RCT)	**M**	• Meta-Analysis or Systematic Review • Decision Analysis • Cost-Benefit Analysis • Cost-Effectiveness Study
B	Cohort study		
C	• Non-randomized trial with concurrent or historical controls • Case-control study • Study of sensitivity and specificity of a diagnostic test • Population-based descriptive study • Time series	**R**	• Narrative Review (review article) • Consensus Statement • Consensus Report
D	• Cross-sectional study • Case series • Case report • Before and after study	**X**	Medical Opinion

Sign	Meaning
+	The report has clearly addressed issues of inclusion/exclusion, bias, generalizability and data collection analysis.
--	The issues above have not been adequately addressed.
Ø	The report is neither exceptionally strong nor exceptionally weak
N/A	The report is not a primary reference and thus, the quality has not been assessed.

Article Summaries

1. Fruit and Vegetable Intake and Risk of Cardiovascular Disease in Elders and Adults

Hu F, Rimm E, Stampfer M, Ascherio A, Spiegelman D, Willett W. Prospective Study of Major Dietary Patterns and Risk of Coronary Heart Disease in Men. *Am J Clin Nutr* 2000; 72:912-921.

Rank: B+

This is an 8 y, prospective cohort study of 44875 men (all health professionals) aged 40-75 y without diagnosed cardiovascular disease or cancer at baseline in 1986. The purpose of the study was to examine whether certain dietary patterns could predict the risk of CHD in men.

Information was obtained through validated food frequency questionnaires and dietary records. It was updated every 2 years. From this data, two major dietary patterns were obtained by factor analysis. The first one was referred to as the Prudent pattern (high intakes of fruits, vegetables, legumes, whole grains, fish and poultry) and the second one was called the Western pattern (high intakes of red meat, processed meat, refined grains, French fries, high fat dairy, sweets and desserts). After adjustment for all the relevant confounders, the study found a decrease of 25% in the risk of CHD between the lowest and highest quintiles of prudent pattern scores; and an increase of 43% in the risk of CHD between the highest and lowest quintiles of western pattern scores. All the values and trends were statistically significant. What does this mean? It means that people consuming a prudent diet can decrease their risk of CHD up to 25% and those consuming a western diet can increase their risk of CHD up to 43%.

One point to keep in mind is that the results only apply to male professionals, between 40 and 75 years of age.

Liu S, Manson J, Lee I, Cole S, Hennekens C, Willett W, Buring J. Fruit and Vegetable Intake and Risk of Cardiovascular Disease: The Women's Health Study. *Am J Clin Nutr* 2000; 72:922-8.

Rank: B-

This is a 5 y, prospective cohort study of 39876 female health professionals with no previous history of CVD or cancer. The study started in 1993 and its purpose was to examine the hypothesis that higher fruit and vegetable intake reduces CVD risk. Dietary information was obtained through a validated food frequency questionnaire only at baseline; in 1993.

An inverse association between fruit and vegetable intake and CVD was found, but the trend was not statistically significant. What does this mean? It simply means that the trend found between the lowest and highest quintiles of fruit and/or vegetable intakes was not a linear (or defined) one.

Additionally, the highest quintile of fruit and/or vegetable intake showed a decrease in CVD risk, but it was statistically significant only for the calculations of fruit and vegetables combined and for vegetables alone (not for fruits alone). This might

indicate that vegetables, more than fruits, are the most influential factor in predicting CVD risk.

Keep in mind that diet was assessed only once, so if there was any change in intake of fruit and vegetables it could not be elucidated and would definitely affect the temporality criteria. Also this specific group of women had an average intake of fruits and vegetables much higher than the general US population.

Joshipura K et al. The Effect of Fruit and Vegetable Intake and Risk of Coronary Heart Disease. *Ann Intern Med* 2001; 134: 1106-1114.

Rank: B-

This is a prospective cohort study of the association between fruit and vegetable consumption and the risk of CHD. 84251 nurses 34 to 59 years of age were followed for 14 years and 42148 male health professionals 40 to 75 years of age were followed for 8 years. All were free of diagnosed CVD, cancer and diabetes at baseline.
They found an inverse association between fruit and vegetable intake and coronary heart disease risk. The highest decrease in risk was attributed to green leafy vegetables and vitamin C rich fruits and vegetables in both cohorts. The strongest and statistically significant reduction in risk appeared in individuals with an intake of 8 or more servings of fruit and vegetables daily.

The applicable this study is to the general population is questionable because it only included health professionals which are supposed to be more knowledgeable than the general population in terms of healthy dietary regimes. This is corroborated by the fact that their average intake of fruits and vegetables is much higher than the general population.

Bazzano L, He J, Ogden L, Loria C, Vupputuri S, Myers L, Whelton P. Fruit and Vegetable Intake and Risk of Cardiovascular Disease in US Adults: The First National Health and Nutrition Examination Survey Epidemiologic Follow-Up Study. *Am J Clin Nutr* 2002; 76:93-9.

Rank: B Ø

This a 19 y prospective follow up study examining the relation between fruit and vegetable intake and the risk of cardiovascular disease. It includes 9608 adults (males and females, Caucasians and African Americans) aged 25 to 74 y and free of cardiovascular disease at their baseline examination between 1971 and 1975.
The study found a strong, inverse association of fruit and vegetable intake with the risk for cardiovascular disease and all-cause mortality. The study looked at specific end points including stroke incidence, stroke mortality, ischemic heart disease mortality, cardiovascular disease mortality and all cause mortality. Although all these end-points showed an inverse association with fruit and vegetable intake, not all were statistically significant.

The researchers divided the participants according to frequency of consumption of fruits and vegetables; ranging from less than 1 time a day to more than or equal to 3 times a day. They found that consuming fruits and vegetables 3 times or more a day (vs. less than once a day) was associated with a 27% lower stroke incidence (statistically significant), a 42% lower stroke mortality (non-significant), 24% lower ischemic heart disease mortality (non-significant), a 27% lower cardiovascular disease

mortality (statistically significant) and a 15% lower all-cause mortality (non-significant). Since this study included a cohort of participants from the general US population, the results could be generalized to the US population.

Rissanen TH, Voutilainen S, Virtanen JK, Venho B, Vanharanta M, Mursu J, Salonen JT. Low Intake of Fruits, Berries and Vegetables is Associated with Excess Mortality in Men: The Kuopio Ischeamic Heart Disease Risk Factor (KIHD) Study. *J Nutr* 2003; 133:199-204.

Rank: B+

This is a prospective cohort study of 2682 middle aged men (42-60y at baseline) that took place in Finland and had a mean follow-up time of 12.8y. The objective of the study was to test the hypothesis that a diet resembling the Mediterranean diet; high in fruit, berry and vegetable intake is associated with a decreased risk of all-cause cardiovascular (CVD) and non-CVD-related mortality. Dietary intake was assessed by 4-d food intake records during the baseline phase only.

Results from this study indicate that a high consumption of fruits, berries and vegetables is associated with a reduced risk of CVD-related, non-CVD related and overall mortality. Compared to the lowest intake group, the risk of CVD mortality for those in the highest intake category was 37% lower. The risk for non-CVD related mortality in this same group was 13% lower. This is after adjustment for all confounders measured. The lowest risk in both, CVD and non-CVD related mortality, appeared in the 4^{th} quintile of intake; i.e. in the group of intake before the highest.

Regarding the number of deaths in this study, there appeared to be a significant and consistent trend of a decreasing number of deaths with an increased intake of fruits, berries and vegetables.

Results from this study can not be generalized to the US population because the subjects were Finnish.

Mozaffarian D, Kumanyika Sh, Lemaitre R, Olson J, Burke G, Siscovick D. Cereal, Fruit and Vegetable Fiber Intake and the Risk of Cardiovascular Disease in Elderly Individuals. *JAMA* 2003; 289:1659-1666.

Rank: B Ø

This is a prospective cohort study conducted from 1989 until June 2000. It is a population-based, multi-center study among 3588 men and women aged 65 y or older and free of known cardiovascular disease at baseline.

The study found that only cereal fiber consumption was inversely associated with incident cardiovascular disease, lowering the risk by 21%, and this was a statistically significant association. While the observed difference in risk was not large, it was seen with a fairly modest difference in dietary intake (approximately 2 slices of whole grain bread per day). Neither fruit fiber, nor vegetable fiber intake were associated with incident cardiovascular disease.

2. Fruit and Vegetable Intake and Risk of Cancer in Elders and Adults

Cohen J, Kristal A, Stanford J. Fruit and Vegetable Intakes and Prostate Cancer Risk. *Journal of the National Cancer Institute* 2000; 92:61-68.

Rank: B-

This is a population-based, case-control study of the relation of fruit and vegetable intake and risk of prostate cancer. Participants included 1230 men (628 cases and 602 controls) aged 40 to 64 years of age. A comprehensive, self-administered food frequency questionnaire was used to assess diet over the 3 to 5 year period before diagnosis (in cases) or recruitment (in controls).

It found an inverse, statistically significant association between vegetable intake, specifically cruciferous vegetables, and prostate cancer. On the other hand, it found no association between fruit intake and prostate cancer risk. These results were obtained after adjustment for all potential confounders.

Although recall bias and self-selection bias might have taken place and affected the results, the researchers tried to correct for these as much as they could.

Feskanich D, Ziegler R, Michaud D, Giovannucci E, Speizer F, Willett W, Colditz G. Prospective Study of Fruit and Vegetable Consumption and Risk of Lung Cancer Among Men and Women. *Journal of the National Cancer Institute* 2000; 92:1812-23.

Rank: B+

This is a 16 y, prospective cohort study examining the association between lung cancer risk and consumption of fruits and vegetables. Participants included 77283 women (30-55 y) from the Nurses' Health Study and 47778 men (40-75 y) from the Health Professionals' Follow-up Study. Data was collected through validated food frequency questionnaires.

The study found that only in women, consumption of vegetables was inversely associated with risk of lung cancer in a statistically significant way.
Also total fruit and vegetable intake appeared protective against lung cancer among both men and women who never smoked in a statistically significant way.
Generalizability of the study is questionable due to the type of participants included in it. They were all health professionals but nothing was mentioned about ethnicity.

Terry P, Giovannucci E, Michels K, Bergkvist L, Hansen H, Holmberg L, Wolk A. Fruits, Vegetables, Dietary Fiber and the Risk of Colorectal Cancer. *Journal of the National Cancer Institute* 2001; 93:525-33.

Rank: B Ø

This is an 8 y, prospective cohort study of 61463 Swedish women between the ages of 40 and 74 y and free of cancer at baseline in 1990. This population is characterized by low consumption of fruits and vegetables and high consumption of cereals. Data was examined with a validated food frequency questionnaire.
Results show an inverse association between fruit and vegetable consumption and colorectal cancer risk (A slight decrease in risk in the highest category of fruit and vegetable intake, but a relatively high increase in risk in the lowest category of intake). Subanalyses show that this association is due largely to fruit consumption, only this association was statistically significant, and was strongest for the risk of rectal cancer. On the other hand, cereal fiber was not associated with colorectal cancer risk.

The results of this study might not be generalizable to the US population because its participants are only Swedish.

Van Gils C et al. Consumption of Vegetables and Fruits and Risk of Breast Cancer. *Jama* 2005; 293:183-193.

Rank: B+

This is a 7 y, prospective cohort study of the relation of breast cancer risk and the intake total and specific fruits and vegetables. Participants included were those taking part in the European Prospective Investigation into Cancer and Nutrition (EPIC) study, a large prospective collaboration project carried out in 10 European countries. A total of 285526 women aged 25 to 70 y were recruited from 8 of 10 of the participating countries were followed up from 1992 to 2002. They were all free of cancer at baseline.

The study results suggest that total or specific vegetable and fruit intake is not associated with risk for breast cancer.

Michaud D, Skinner H, Wu K, Hu F, Giovannucci E, Willett W, Colditz G, Fuchs C. Dietary Patterns and Pancreatic Cancer Risk in Men and Women. *Journal of the National Cancer Institute* 2005; 97:518-23.

Rank: B-

This is a prospective cohort study whose purpose is to determine whether certain dietary patterns are associated with pancreatic cancer risk. A total of 47493 men from the Health Professionals Follow-up Study, aged 40 to 75 y, and 77179 women from the Nurses Health Study, aged 34 to 59 years of age were followed for an average of 15 years. All free of diagnosed cancer baseline. Data was collected by means of a 130-item food frequency questionnaire. From this data, two major dietary patterns were obtained by factor analysis. The first one was referred to as the Prudent pattern (high intakes of fruits, vegetables, legumes, whole grains, fish and poultry) and the second one was called the Western pattern (high intakes of red meat, processed meat, refined grains, French fries, high fat dairy, high-sugar drinks, sweets and desserts). These patterns were both validated.

The study found no association between the risk of pancreatic cancer and any of the dietary patterns established.

The generalizability of the results of this study is minimal because it included male and female health professionals only. This same characteristic could have had a great influence in the data obtained by biasing it.

3. Fruit and Vegetable Intake and Risk of Diabetes in Elders, Adults and Children

Liu S, Serdula M, Janket S, Cook N, Sesso H, Willett W, Manson J, Buring J. A Prospective Study of Fruit and Vegetable Intake and the Risk of Type 2 Diabetes in Women. *Diabetes Care* 2004; 27:2993-6.

Rank: B-

This is a 10 y, prospective cohort study of the relation between fruit and vegetable intake and the risk of type 2 diabetes in women. Participants were chosen from the Women's Health Study and they included 38897 female health professionals 45 y or older, who were free of heart disease, stroke or cancer at baseline in 1993. Participants also had no previously diagnosed diabetes. Dietary data was compiled with

a validated food frequency questionnaire. Diagnosis of type 2 diabetes was based on self-reports.

After adjustment for the known risk factors, the study found no inverse association between total intake of fruits and vegetables and risk of incident type 2 diabetes in all the women studied. But, when they divided the participants according to BMI, into those with a BMI ≥25 and those with a BMI< 25, they found that a high intake of green leafy vegetables or dark yellow vegetables was associated with a reduced risk of type 2 diabetes among overweight women. These results were statistically significant.

The generalizability of this study is definitely questionable since it comprises only female health professionals.

Lee D, Steffen M, Jacobs D Jr. Association Between Serum Gamma-Glutamyltransferase and Dietary Factors: the Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Am J Clin Nutr* 2004; 79:600-5.

Rank: B+

This is a 10 y, prospective cohort study of the relation between certain dietary factors and serum Gamma-Glutamyl-Transferase (GGT) activity. In previous epidemiologic studies Serum GGT concentration within the normal range was associated with most cardiovascular disease risk factors and was a predictor of future heart disease, hypertension, stroke and type 2 diabetes. In particular, serum GGT showed a strong graded relation with diabetes which suggested a role for GGT in the pathogenesis of the disease. However, the mechanisms underlying this association remain largely unknown, although mechanisms related to oxidative stress have been suggested.

Since information on the dietary determinants of serum GGT concentrations is limited, this study sought to elucidate the nature of dietary correlates of serum GGT activity.

A total of 3146 participants from the CARDIA study were followed, these consisted of 566 black men, 805 black women, 837 white men and 938 white women. Ages ranged between 17 and 35 years. Dietary information was collected by means of a validated food frequency questionnaire. Food items were classified into alcohol; breaded, battered or canned vegetables; fruit; fruit juice; refined grain; whole grain; dairy; legumes; meat; poultry; fish; fresh or frozen vegetables; nuts and coffee.

After adjustment for non-dietary and dietary factors, a statistically significant positive association was found between GGT and alcohol consumption and meat intake. Though wine intake was only minimally associated; the inverse association was much weaker than that with beer and liquor. Also a statistically significant, inverse association was found with fruit consumption. An inverse association was also found with vegetable consumption but it was not statistically significant.

This is a fairly representative study of the US population because it included white as well as black subjects.

Van Dam R, Rimm E, Willett W, Stampfer M, Hu F. Dietary Patterns and Risk of Type 2 Diabetes Mellitus in U.S. Men. *Ann Intern Med* 2002; 136:201-209.

Rank: B+

This is a 12 y, prospective cohort study of the role of diet in the development of type 2 diabetes mellitus. Participants included 42504 male health professionals (from The Health Professionals Follow-up Study), 40 to 75 years of age, predominantly white and without diagnosed diabetes, cardiovascular disease or cancer at baseline in 1986.
Dietary information was obtained with a validated food frequency questionnaire and two major dietary patterns were established: 1) the prudent pattern which is characterized by a high consumption of vegetables, fruits, fish, poultry and whole grains; and 2) the western pattern which is characterized by high consumption of red meat, processed meat, high-fat dairy products, French fries, refined grains, sweets and desserts.

After adjustment for all the possible confounders, a modestly lower risk for type 2 diabetes was associated with the prudent diet. The western pattern; however, was associated with a substantially higher risk for type 2 diabetes mellitus. The results also showed that the combination of a western dietary pattern with a low level of physical activity or obesity was associated with a particularly high risk for type 2 diabetes.
Generalizability of study results applies only to white US male health professionals.

Nelson K, Reiber G, Boyko E. Diet and Exercise Among Adults With Type 2 Diabetes. *Diabetes Care* 2002; 25:1722-8.

Rank: C-

This is a multi-center, population-based descriptive study looking at the trends in diet and exercise among adults with type 2 diabetes. It includes 1480 adults (Caucasians, African Americans and Mexican Americans) older than 17 years of age with a self-reported diagnosis of type 2 diabetes in the Third National Health and Nutrition Examination Survey (NHANES III). Some dietary data was obtained with a validated food frequency questionnaire and some with a 24 h dietary recall.
Several trends were including the finding that 62% of individuals reported eating fewer than 5 servings of fruits and vegetables per day. Those individuals over the age of 65 ate a higher number of fruits and vegetables and this was mostly seen among Mexican Americans.

Trevino RP, Marshall RM, Hale DE, Rodriguez R, Baker G, Gomez J. Diabetes Risk Factors in Low-Income Mexican-American Children. *Diabetes Care* 1999; 22:202-207.

Rank: D Ø

This is a cross-sectional study of 173 low-income, Mexican-American fourth graders from two public schools in San Antonio-Texas and aged 9 years. The purpose of the study was to learn if these children had excess diabetes risk factors. The diabetes risk factors measured were percent body fat, dietary fat intake, daily fruit and vegetable intake, physical fitness and family history of diabetes.

After assessment of all of these risk factors, researchers found that these children ate higher than recommended fat servings and had higher percent energy from fat and saturated fat. On the contrary, their fruit and vegetable intake was half of that recommended by national dietary guidelines. 38% of these children had unacceptable physical fitness scores (PFS), 49% had marginally acceptable PFS and only 13% had acceptable PFS. Percent body fat was higher in these children than that reported for

non-Hispanic White children and higher than the recommended values. 60% of these children had a first or second-degree relative with diabetes.

Due to the descriptive nature of this study, no causation could be assessed. However, due to the high prevalence of diabetes in this ethnic group, it is important to have an idea about some of the possible modifiable risk factors for diabetes that this population might have. This could provide us with some insight into possible preventive intervention strategies for the future.

4. Nutrition Interventions Aimed at Promoting Fruit and Vegetable Intake in:

A. Elders

Bernstein A, Nelson M, Tucker K, Layne J, Johnson E, Nuernberger A, Castaneda C, Judge J, Buchner D, Singh MF. A Home-Based Nutrition Intervention to Increase Consumption of Fruits, Vegetables, and Calcium-Rich Foods in Community Dwelling Elders. *J Am Diet Assoc* 2002; 102:1421-1427.

Rank: A-

This is a 6 month, randomized trial assessing the efficacy a home-based nutrition intervention would have on the intake of fruits, vegetables and calcium-rich foods of community dwelling, functionally impaired elders. Participants, recruited from the Greater Boston area, included 70 men and women, 70 years or older, mainly white (97%) and who were randomized to either a nutrition education intervention (n=38) or a control group that received an exercise intervention (n=32). The case group received intensive nutrition education at home, by phone and by mail, whereas the exercise group (controls) received instead exercise education through the same means. Dietary information was collected with a validated food frequency questionnaire at the beginning and end of the 6 month period.

As a result, the nutrition intervention group increased their caloric intake by around 200 Kcals/day and their intake of fruits, vegetables and calcium rich foods increased by 1 serving/day each. The controls did not show any change.

Johnson D, Beaudoin S, Smith L, Beresford S, LoGerfo J. Increasing Fruit and Vegetable Intake in Homebound Elders: The Seattle Senior Farmers' Market Nutrition Pilot Program (SSFMNPP). www.cdc.gov Jan 2004.

Rank: A Ø

This is a 6 month, randomized trial to assess the efficacy of the SSFMNPP in increasing fruit and vegetable consumption among homebound elders.

In the summer and fall of 2001, the SSFMNPP provided 480 low income, homebound seniors with a biweekly home delivery of a market basket that combined a variety of seasonal local produce. An average of 1.6 servings of vegetables and 0.67 servings of fruit were provided per day and the baskets included dark green or orange fruits and vegetables. Accompanying each basket there was a newsletter that described the produce, provided recipes for less common seasonal foods and promoted eating fruits and vegetables.

Subjects included low-income, home-bound seniors, 60 years or older who were black, white or Hispanic. Cases were recruited from among the program members and controls were recruited from outside the program's service area. 87 cases and 44

controls completed the study. A 6-question questionnaire was administered by phone to all participants at the beginning and end of the study to assess fruit and vegetable intake.
The proportion of program participants (cases) who consumed 5 or more servings of fruit and vegetable a day increased from 22% to 39% at the end of the study, while the proportion of seniors in the control group decreased from 30% to 23%. The cases increased their intake by an average of 1.31 servings of fruit and vegetables a day.

B. Adults

Anderson J, Bybee D, Brown R, McLean D, Garcia E, Breer L, Schillo B. 5 A Day Fruit and Vegetable Intervention Improves Consumption in a Low Income Population. *J Am Diet Assoc* 2001; 101:195-202.

Rank: C-

This is a 4-month, non-randomized clinical trial whose purpose is to test the effectiveness of project FRESH in increasing fruit and vegetable intake through coupons and education. This study examines the effect of the program on attitudes about buying, preparing and eating fruits and vegetables, redemption of coupons and the number of fruit and vegetable servings consumed.

The study involved 455 low income women from the Genesee county in Michigan. They were recruited from the Women, Infant and Children (WIC) program as well as from the Community Action Agency Commodity Supplemental Food Program (CSFP). 43.3% of the subjects recruited were African-American, 49.4% were white and 7.3% were from other racial groups. Subjects were assigned to on of four interventions: 1) Education about use, storage and nutritional value of fruits and vegetables; 2) Distribution of Farmers' Market coupons; 3) Education + Coupons; or 4) No intervention.
A self-administered questionnaire before and after the intervention, which was not previously validated, measures attitudes about fruits and vegetables. WIC records documented redemption of coupons.

Results show that all, except the no intervention group, showed positive outcomes. The coupons-only intervention had a direct impact on behavior, whereas the education-only intervention had a direct effect on attitudes and through them on behavior. But the highest effect was achieved with the education + coupons intervention. These results show that one can increase consumption of fruits and vegetables in a certain population by removing the barriers to affordability.

This study has a high generalizability because it included a very high proportion of a minority population and it had very good response rate. On the other hand, because the groups were not all chosen from the same program and thus, differed in many respects, one should be very careful when drawing conclusions.

Buller D, Morrill C, Taren D, Aickin M, Sennott-Miller L, Buller K, Larkey L, Alatorre C, Wentzel T. Randomized Trial Testing the Effect of Peer Education at Increasing Fruit and Vegetable Intake. *J Natl Cancer Inst* 1999; 91:1491-1500.

Rank: A+

This study is a randomized trial that took place in two Southwestern US cities (Tucson and Phoenix) where in general the population has less information about

cancer and nutrition than the rest of the US. Its purpose was to test the effectiveness of a peer health education program in improving consumption of fruits and vegetables of a lower socioeconomic, multicultural labor and trades employees at their workplaces. 2091 employees completed a baseline survey and received an 18-month intervention program through standard communication channels such as workplace mail, cafeteria promotions and speakers. This program provided a baseline awareness level of the 5 A Day for better health program and thus, the 2091 employees were educated about the role of nutrition in health and well-being. Once all employees were educated under a controlled environment, 905 agreed to continue with the intervention. The 905 remaining employees were divided into 41 matched pairs of cliques (group of employees that are socially close), with one clique per pair being assigned to the peer education intervention. By a series of surveys and a grading system, the researchers chose the peer educator responsible for providing nutrition education to his peers in the clique. The peer educator was the one with the closest ties to all subjects in his/her clique and was central in the communication flow. The peer education intervention occurred during the last nine months of the program.

Fruit and vegetable intake was measured with a 24-hr dietary recall and a food frequency questionnaire at baseline, outcome (at the 18th month) and at 6-month follow-up (at the 24th month) surveys.

Results from this well designed and implemented study show a statistically significant increase of an average of 0.62 total daily servings. This effect persisted at the 6-month follow up survey. Thus, peer education appears to be effective at increasing consumption of fruits and vegetables in employees of low socioeconomic status and from multicultural backgrounds.

C. Children

Horne PJ, Tapper K, Lowe CF, Hardman CA, Jackson MC, Woolner J. Increasing Children's Fruit and Vegetable Consumption: A Peer-Modeling and Rewards-Based Intervention. *European Journal of Clinical Nutrition* 2004; 58:1649-1660.

Rank: C+

This is a non-randomized trial designed to evaluate the effect a peer-modeling and rewards based intervention would have on children's intake of fruits and vegetables. It included 749 children aged between 5 and 11y. The children attended two inner-city London schools that were similar in terms of size, location, proportion of children from ethnic minorities and level of social deprivation (as assessed by the proportion of children entitled to free school meals). One of these schools was designated as the experimental one and the other as the control school by the education authority in a non-random manner. In the experimental school the intervention consisted of a 12-day data collection baseline component, followed by a 16-day intervention and a 4-month maintenance. The first 12 days of data collection consisted of observing children's intake of fruits and vegetables during lunch time by designated school staff. The intervention consisted of showing the children 6-min peer-modeling videos of animated super heroes whose mission was to encourage consumption of fruits and vegetables by modeling the behavior. Also letters from these super heroes would be read every morning to the children in order to provide them with encouragement and praise. Children were also given 'home packs' to encourage

consumption of fruits and vegetables at home and to involve the parents as well. These home packs carried educational material for the parents as well as food record sheets for the kids to complete. During lunch, all children were provided with the opportunity to choose among four types of fruits and four types of vegetables and they were rewarded for consuming a minimum amount everyday. Only kids aged 5 to 7 years were, in addition, provided with a mid-morning snack of whole fruit and were rewarded for tasting or consuming a minimum amount. During the maintenance phase, no videos were showed and letters were read only once a week, but rewards were still in place whenever children consumed a minimum amount of fruits and vegetables, even though these rewards became more intermittent. A total of two home packs were delivered to parents, one at the beginning of the intervention and another at the beginning of maintenance. Consumption of fruits and vegetables by the children was measured on a daily basis visually, by at least three independent raters. Snack-time consumption was measured by weighing each child's fruit before and after consumption. Consumption at home was assessed using a 24-h food recall, administered by parents during the first week at baseline and during the last two weeks of the intervention. Parents used food diaries to aid their recall.

The control school had no super heroes program. The only common features were that fruits and vegetables were made available to all children at lunchtime, fruit was provided to 5-7y olds at snack time and measures of consumption were equally taken.

Compared to the control school, lunchtime consumption in the experimental school was much higher at intervention and follow-up, whereas snack-time consumption was higher only at intervention. These values were statistically significant. Particularly large increases were seen among those children who initially ate very little fruits and vegetables. Significant increases were also seen at home.

Since this intervention was done in England, results can not be generalized to US children.

Perry CL, Bishop DB, Taylor GL, Davis M, Story M, Gray C, Bishop SC, Mays RA, Lytle LA, Harnack L. A Randomized School Trial of Environmental Strategies to Encourage Fruit and Vegetable Consumption Among Children. *Health Education and Behavior* Feb 2004; 31:65-76.

Rank: A-

This is a school-based, randomized trial with the aim of increasing fruit and vegetable consumption in first and third graders. During 2 consecutive school years, 26 elementary schools, from one school district in Minnesota, were randomly assigned to be either an intervention or a control school. All the schools had an enrollment that was 90% white. The final study sample (n=1668) was 49% female. The intervention provided additional opportunities to eat fruits and vegetables (increased availability, appeal and encouragement of fruits and vegetables by food service staff in the school lunch program, the lunch line and the school snack cart), provided positive role models (flyers, student helpers for sampling of fruits and vegetables, actors in a play done to encourage fruit and vegetable intake), and provided increased social support from food service staff, parent volunteers and social activities (including a one-time competition to consume at least 3 servings of fruits and vegetables and an educational activity about

recipes including grapes). Fruit and vegetable intake was measured by observation of students during lunchtime. An average of 32 students was observed per school grade once at baseline and at follow-up. Trained observers recorded all items eaten at lunch and their portion size. A median of 9 observations per school were done during the second intervention year. Observations were done in all schools equally, but the intervention occurred only in 13 of them. Training of food-service staff and cook managers was ongoing throughout the intervention.

A statistically significant increase in intake was observed for fruits, but not for vegetables; though this change was rather modest. Process measures indicated that verbal encouragement by food service staff was associated with the outcome.

Because the increment in intake was very modest, it is suggested that multi-component interventions might have more powerful effects than cafeteria-only interventions.

5. Fruit and Vegetable Intake and Blood Pressure

Moore LL, Singer MR, Bradlee ML, Djousse L, Proctor MH, Cupples LA, Ellison RC. Intake of Fruits and Vegetables and Dairy Products in Early Childhood and Subsequent Blood Pressure Change. *Epidemiology 2005*; 16:4-11.

Rank: B+

This is a prospective cohort study involving 95 children (and their parents) from the Framingham Children's Study. The purpose of the study was to estimate the independent and combined effects of fruits and vegetables and dairy products on childhood blood pressure from preschool to early adolescence. The children were between 3 and 5.9 y of age at entry and were followed prospectively until they reached 12 years of age. At baseline (during the first year) each child's diet was assessed with 4 sets of 3-day diet records. During subsequent years only 2 sets per year were collected. Diet records were, in a similar manner, completed for parents as well. The children and their parents were assessed yearly at clinic visits by means of interviews, questionnaires and measurements of anthropometry, blood pressure and blood lipids. Parents' information was collected in order to include all possible confounders in the statistical analysis.

Results of this study suggest that diets characterized by higher intakes of fruits and vegetables and higher intakes of dairy (whether full or low fat) have beneficial effects on childhood blood pressures. The combination of higher dairy and higher fruit and vegetable consumption provided the greatest blood pressure benefit. Children with higher preschool intake in both food groups had a mean systolic blood pressure of 106 mmHg by the time of early adolescence. While those with lower intakes of both food groups had a mean systolic blood pressure of 113 mmHg by the same age. Those with higher intakes of fruits and vegetables alone or dairy alone had intermediate levels of adolescent systolic blood pressure. Trends for diastolic blood pressure were weaker. All of these findings were consistent even after adjusting for many important confounders.

Miura K, Greenland P, Stamler J, Liu K, Daviglus ML, Nakagawa H. Relation of Vegetable, Fruit and Meat Intake to 7-Year Blood Pressure Change in Middle-Aged Men:

The Chicago Western Electric Study. *American Journal of Epidemiology* 2004; 159:572-580.

Rank: B-

This is a prospective cohort study using subjects from the Chicago Western Electric Study; a long-term, prospective population study principally of coronary heart disease and its precursors. The purpose of the study was to evaluate the effect vegetables, fruits and meat consumption have on subsequent 7-year blood pressure change. The 1,710 subjects were middle-aged men with an average age of 49y (41-57y) at baseline and the majority were from European descent.

Baseline dietary information was the average of two standardized interviews and food frequency questionnaires done by dietitians in the first and second examination years. Follow-up surveys were conducted for 7 years after the second examination year. During the follow-up surveys on dietary information, blood pressure, weight, serum cholesterol, medical history, physical examination and electrocardiograms were obtained. Baseline blood pressure was obtained during the second examination year. At baseline, average blood pressure was at the high-normal level.

Several confounders were included in the regression models except for physical activity, NACL, potassium, magnesium and fiber intake.

The study consisted of following the diet and blood pressure of these men for 9 years. The first two years were used to collect baseline data and the last seven years were used for follow-up. Results of the study are as follows: 1) Higher intakes of vegetables and/or fruits were related to less of an increase in systolic and diastolic blood pressure over time, though results were not all statistically significant; 2) Men with a higher intake of red meat had significantly greater increases in blood pressure; 3) Men with the higher poultry intake also had a significantly greater higher increase in blood pressure; and 4) Men with a higher fish intake tended to have less of an increase in blood pressure, although this was not statistically significant.

Given possible differences in the pathophysiology of hypertension across population subgroups, these findings may or may not be generalizable beyond middle-aged, non-Hispanic, White males.

6. Fruit and Vegetable Intake and Bone Mineral Density

Tylavsky FA, Holliday K, Danish R, Womack C, Norwood J, Carbone L. Fruit and Vegetable Intakes are an Independent Predictor of Bone Size in Early Pubertal Children. *Am J Clin Nutr* 2004; 79:311-317.

Rank: A-

This is a cross-sectional, randomized, calcium supplementation trial involving 56 white females between the ages of 8 and 13 years. The study had two purposes: 1) to evaluate the influence of fruit and vegetable intakes on urinary calcium excretion and bone mass in this group of early pubertal girls, and 2) to evaluate whether parathyroid hormone (PTH), 25-hydroxyvitamin D (25-OH-D) and markers of bone formation and reabsorbtion were related to fruit and vegetable intakes.

Subjects completed height, weight and bone measurements and provided a 24-h urine sample, a blood sample and a 1-day food record prior to randomization. They

were randomized to receive either a 1000 mg pill of calcium carbonate/day or a placebo. After randomization, they were asked for two additional 1-day food records on two different days. A total of 3-day food records were collected for the study. A 1-day physical activity checklist was completed by the girls on the same days as the food records. All physical activities for a 24-h period, including activities of daily living, were recorded. Dual-energy X-ray absorptiometry (DXA) was used to measure bone area, bone mineral content (BMC) and bone mineral density (BMD) of the whole body and non-dominant wrist.

According to their food records, subjects were grouped into two consumption groups; the low consumption group (n=22) which consumed < 3 servings per day of fruits and vegetables per day; and the high consumption group which had an intake of ≥ 3 servings of fruit and vegetables per day.

Results show that compared with the low consumption group, the high consumers had a 6% to 8.3% larger bone area of the radius and whole body. These results were statistically significant (P=0.03). BMC of whole body (7.4%) and wrist (7.0%) was also higher in the high consumption group, but non-statistically significant. They also had a lower urinary output of calcium and this remained statistically significant even after adjustment for confounders. Biomarkers of bone turnover, body mass density and 25-OH-D stores did not differ between the two groups. PTH concentrations were higher in the low consumption group.

Tucker KL, Chen H, Hannan MT, Cupples LA, Wilson P, Felson D, Kiel DP. Bone Mineral Density and Dietary Patterns in Older Adults: The Framingham Osteoporosis Study. *Am J Clin Nutr* 2002; 76:245-252.

Rank: B+

This is a prospective cohort study evaluating the associations between dietary patterns and bone mass density (BMD) in the elderly cohort of the Framingham Osteoporosis Study. A total of 907 subjects (38% male) between the ages of 69 and 93 y completed a 126-item, validated, food frequency questionnaire at baseline. Confounders measured included age, height, weight, BMI, physical activity, smoking status, estrogen use by women and use of calcium and vitamin D supplements by both. Researchers also included a categorical variable for time of BMD measurement, since BMD is affected by seasonal changes.

With data from the food frequency questionnaires, the researchers identified six different dietary patterns: 1) the meat, dairy and bread group (n=313), 2) the meat and sweet baked products group (n=260), 3) the sweet baked products group (n=69), 4) the Alcohol group (n= 81), 5) the candy group (n= 75) and 6) the fruits, vegetables and cereal group (n= 109). Subjects derived the majority of their caloric intake from the foods specified in their group title. All the remaining foods were almost equally consumed among all.

Results show that men with a diet high in fruit, vegetable and cereal had significantly greater BMD than did men with other dietary patterns. In contrast, those consuming most candy had significantly lower BMD than did most other groups. Results were not as clear among women, but the high candy eaters consistently had the lowest BMD. Women in the alcohol group, consuming an average of two drinks per day, had the highest BMD in most sited except at the Ward's area where those in the fruit and

vegetable group had the highest BMD. Among women, the fruit and vegetable group had the second highest BMD in all areas except at the Ward's area.

These results show the beneficial effects of a high fruit, vegetable and cereal diet that also low in less nutrient dense foods. Such a diet may contribute to better accumulated BMD in old age, particularly in men.

Appendix A

List of Articles with Ratings

Study	Grade
1. Cardiovascular Disease:	
Van Doorn M, Espirito Santo S, Meijer P, Kamerling I, Schoemaker R, Dirsch V, Vollmar A, Haffner T, Gebhardt R, Cohen A, Princen H, Burggraaf J. Effect of garlic powder on C-reactive protein and plasma lipids in overweight and smoking subjects. *Am J Clin Nutr* 2006;84: 1324-1329.	A+
Daviglus M, et al. Relationship of Fruit and Vegetable Consumption in Middle-Aged Men to Medicare Expenditures in Older Age: The Chicago Western Electric Study. *JADA.* 2005;105:1735-1744	B+
Hu F, Rimm E, Stampfer M, Ascherio A, Spiegelman D, Willett W. Prospective Study of Major Dietary Patterns and Risk of Coronary Heart Disease in Men. *Am J Clin Nutr* 2000; 72:912-921.	B+
Mozaffarian D, Kumanyika Sh, Lemaitre R, Olson J, Burke G, Siscovick D. Cereal, Fruit and Vegetable Fiber Intake and the Risk of Cardiovascular Disease in Elderly Individuals. *JAMA* 2003; 289:1659-1666.	B+
Rissanen TH, Voutilainen S, Virtanen JK, Venho B, Vanharanta M, Mursu J, Salonen JT. Low Intake of Fruits, Berries and Vegetables is Associated with Excess Mortality in Men: The Kuopio Ischeamic Heart Disease Risk Factor (KIHD) Study. *J Nutr* 2003; 133:199-204.	B+
Steffen L, Folsom A, Cushman M, Jacobs D, Rosamond WD. Greater Fish, Fruit, and Vegetable Intakes Are Related to Lower Incidence of Venous Thromboembolism; The Longitudinal Investigation of Thromboembolism Etiology. *Circulation.* 2007;115.	B+
Joshipura K et al. The Effect of Fruit and Vegetable Intake and Risk of Coronary Heart Disease. *Ann Intern Med* 2001; 134: 1106-1114.	B-
Liu S, Manson J, Lee I, Cole S, Hennekens C, Willett W, Buring J. Fruit and Vegetable Intake and Risk of Cardiovascular Disease: The Women's Health Study. *Am J Clin Nutr* 2000; 72:922-8.	B-
Bazzano L, He J, Ogden L, Loria C, Vupputuri S, Myers L, Whelton P. Fruit and Vegetable Intake and Risk of Cardiovascular Disease in US Adults: The First National Health and Nutrition Examination Survey Epidemiologic Follow-Up Study. *Am J Clin Nutr* 2002; 76:93-9.	B Ø
2. Diabetes:	
Lee D, Steffen M, Jacobs D Jr. Association Between Serum Gamma-Glutamyltransferase and Dietary Factors: the Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Am J Clin Nutr* 2004; 79:600-5.	B+
Van Dam R, Rimm E, Willett W, Stampfer M, Hu F. Dietary Patterns and Risk of Type 2 Diabetes Mellitus in U.S. Men. *Ann Intern Med* 2002; 136:201-209	B+

Nelson K, Reiber G, Boyko E. Diet and Exercise Among Adults With Type 2 Diabetes. *Diabetes Care* 2002; 25:1722-8.	C-
Trevino RP, Marshall RM, Hale DE, Rodriguez R, Baker G, Gomez J. Diabetes Risk Factors in Mexican-American Children. *Diabetes Care* 1999; 22:202-207.	D Ø
3. Cancer:	
Feskanich D, Ziegler R, Michaud D, Giovannucci E, Speizer F, Willett W, Colditz G. Prospective Study of Fruit and Vegetable Consumption and Risk of Lung Cancer Among Men and Women. *Journal of the National Cancer Institute* 2000; 92:1812-23.	B+
Van Gils C et al. Consumption of Vegetables and Fruits and Risk of Breast Cancer. *Jama* 2005; 293:183-193.	B+
Cohen J, Kristal A, Stanford J. Fruit and Vegetable Intakes and Prostate Cancer Risk. *Journal of the National Cancer Institute* 2000; 92:61-68.	B-
Larsson S, Hakansson N, Naslund I, Bergkvist L, Wolk A. Fruit and Vegetable Consumption in Relation to Pancreatic Cancer Risk: A Prospective Study. *Cancer Epidemiol Biomarkers Prev* 2006; 15: 301-305.	B -
Michaud D, Skinner H, Wu K, Hu F, Giovannucci E, Willett W, Colditz G, Fuchs C. Dietary Patterns and Pancreatic Cancer Risk in Men and Women. *Journal of the National Cancer Institute* 2005; 97:518-23.	B-
Terry P, Giovannucci E, Michels K, Bergkvist L, Hansen H, Holmberg L, Wolk A. Fruits, Vegetables, Dietary Fiber and the Risk of Colorectal Cancer. *Journal of the National Cancer Institute* 2001; 93:525-33.	B Ø
Chan JM, Wang F, Holly EA. Vegetable and Fruit Intake and Pancreatic Cancer in a Population-Based Case-Control Study in the San Francisco Bay Area. *Cancer Epidemiol Biomarkers Prev* 2005; 14: 2093-2097.	C-
Neto C. Cranberry and Its Phytochemicals: A Review of In Vitro Anticancer Studies. *J Nutr.* 2007; 137:186-193.	R
4. Nutrition Interventions:	
Buller D, Morrill C, Taren D, Aickin M, Sennott-Miller L, Buller K, Larkey L, Alatorre C, Wentzel T. Randomized Trial Testing the Effect of Peer Education at Increasing Fruit and Vegetable Intake. *J Natl Cancer Inst* 1999; 91:1491-1500.	A+
Bernstein E, Nelson M, Tucker K, Layne J, Johnson E, Nuernberger A, Castaneda C, Judge J, Buchner D, Singh MF. A Home-Based Nutrition Intervention to Increase Consumption of Fruits, Vegetables, and Calcium-Rich Foods in Community Dwelling Elders. *J Am Diet Assoc* 2002; 102:1421-1427.	A -
Johnson D, Beaudoin S, Smith L, Beresford S, LoGerfo J. Increasing Fruit and Vegetable Intake in Homebound Elders: The Seattle Senior Farmers' Market Nutrition Pilot Program (SSFMNPP). www.cdc.gov Jan 2004.	A Ø

Richards A, Kattelmann KK, Ren C. Motivating 18- to 24-Year-Olds to Increase Their Fruit and Vegetable Consumption. *J Am Diet Assoc* 2006; 106: 1405-1411.	B+
Horne PJ, Tapper K, Lowe CF, Hardman CA, Jackson MC, Woolner J. Increasing Children's Fruit and Vegetable Consumption: A Peer-Modeling and Rewards-Based Intervention. *European Journal of Clinical Nutrition* 2004; 58:1649-1660.	C+
Perry CL, Bishop DB, Taylor GL, Davis M, Story M, Gray C, Bishop SC, Mays RA, Lytle LA, Harnack L. A Randomized School Trial of Environmental Strategies to Encourage Fruit and Vegetable Consumption Among Children. *Health Education and Behavior* Feb 2004; 31:65-76.	C+
Anderson J, Bybee D, Brown R, McLean D, Garcia E, Breer L, Schillo B. 5 A Day Fruit and Vegetable Intervention Improves Consumption in a Low Income Population. *J Am Diet Assoc* 2001; 101:195-202.	C-
Esmailzadeh A, Kimiagar M, Mehrabi Y, Azadbakht L, Hu F, Willett W. Fruit and Vegetable intakes, C-reactive protein, and the metabolic syndrome. *Am J Clin Nutr.* 2006; 84:1489-1497.	D+
Kristjansdottir AG, Thorsdottir I, Bourdeaudhuij I, Due P, Wind M, Klepp K. Determinants of fruit and vegetable intake among 11-year-old schoolchildren in a country of traditionally low fruit and vegetable consumption. *Intl J Behav Nutr Phys Act* 2006;3.	D-
Zabinski M, Daly T, Norman G, Rupp J, Calfas K, Sallis J, Patrick K. Psychosocial Correlates of Fruit, Vegetable, and Dietary Fat Intake among Adolescent Boys and Girls. *J Am Diet Assoc* 2006; 106: 814-821.	D-
Herman D, Harrison G, Jenks E. Choices Made by Low-Income Women Provided with an Economic Supplement for Fresh Fruit and Vegetable Purchase. *JADA*; 2006;106:740-744.	M+
5. Blood Pressure:	
Adebawo O, Salau B, Ezima E, Oyefuga O, Ajani E, Idowu G, Famodu A, Osilesi O. Fruits and vegetables moderate lipid cardiovascular risk factor in hypertensive patients. *Lipids in Health and Disease* 2006;5: 1476-1480.	A -
Moore LL, Singer MR, Bradlee ML, Djousse L, Proctor MH, Cupples LA, Ellison RC. Intake of Fruits and Vegetables and Dairy Products in Early Childhood and Subsequent Blood Pressure Change. *Epidemiology 2005*; 16:4-11.	B+
Miura K, Greenland P, Stamler J, Liu K, Daviglus ML, Nakagawa H. Relation of Vegetable, Fruit and Meat Intake to 7-Year Blood Pressure Change in Middle-Aged Men: The Chicago Western Electric Study. *American Journal of Epidemiology* 2004; 159:572-580.	B-

6. Bone Mineral Density:	
Tylavsky FA, Holliday K, Danish R, Womack C, Norwood J, Carbone L. Fruit and Vegetable Intakes are an Independent Predictor of Bone Size in Early Pubertal Children. *Am J Clin Nutr* 2004; 79:311-317.	A-
Tucker KL, Chen H, Hannan MT, Cupples LA, Wilson P, Felson D, Kiel DP. Bone Mineral Density and Dietary Patterns in Older Adults: The Framingham Osteoporosis Study. *Am J Clin Nutr* 2002; 76:245-252.	B+
7. Obesity:	
Davis J, Hodges V, Gillham B. Normal- Weight Adults Consume More Fiber and Fruit that Their Age- and Height-Matched Overweight/Obese Counterparts. *J Am Diet Assoc* 2006; 106: 833-840.	C+
Bes-Rastrollo M, Martinez-Gonzalez M, Sanchez-Villegas A, de la Fuente Arrillaga C, Martinez JA. Association of fiber intake and fruit/vegetable consumption with weight gain in a Mediterranean population. *Nutrition* 2006: 504-511.	D -

Appendix B

Additional Readings

1. Lock K, Pomerleau J, Causer L, Altman DR, McKee M. The Global Burden of Disease Attributable to Low Consumption of Fruit and Vegetable: Implications for the Global Strategy on Diet. *Bulletin of the World Health Organization*. Feb 2005;83:100-108.
2. Steffen LM, Jacobs DR, Stevens J, Shahar E, Carithers T, Folson AR. Associations of Whole-Grain, Refined Grain, and Fruit and Vegetable Consumption with Risks of All-Cause Mortality and Incident Coronary Artery Disease and Ischemic Stroke: The Artherosclerosis Risk in Communities (ARIC) Study. *Am J Clin Nutr* 2003; 78:383-390.
3. Cox BD, Wichelow MJ, Prevost AT. Seasonal Consumption of Salad Vegetables and Fresh Fruit in Relation to the Development of Cardiovascular Disease and Cancer. *Public Health Nutrition* 1999; 3:19-29.
4. Riboli E, Norat T. Epidemiologic Evidence of the Protective Effect of Fruit and Vegetables on Cancer Risk. *Am J Clin Nutr* 2003; 78:559s-569s.
5. Donaldson Michael S. Nutrition and Cancer: A Review of the Evidence for an Anti-Cancer Diet. *Nutrition Journal* 2004; 3:19-39.
6. Reddy SK, Katan MB. Diet, Nutrition and the Prevention of Hypertension and Cardiovascular Diseases. *Public Health Nutrition* 2004; 7:167-186.
7. Van Duyn MS, Pivonka E. Overview of the Health Benefits of Fruit and Vegetable Consumption for the Dietetics Professional: Selected Literature. *J Am Diet Assoc.* 2000; 100:1511-1521.
8. Pollack Susan L. Consumer Demand for Fruit and Vegetables: The U.S. Example. *Changing Structure of Global Food Consumption and Trade 2001.* Economic Research Service/USDA.
9. Kant Ashima K. Dietary Patterns and Health Outcomes. *J Am Diet Assoc* 2004; 104:615-635.
10. Liu Rui H. Health Benefits of Fruits and Vegetables are from Additive and Synergistic Combinations of Phytochemicals. *Am J Clin Nutr* 2003; 78:517s-520s.
11. Blackburn George L. The Public Health Implications of the Dietary Approaches to Stop Hypertension Trial. *Am J Clin Nutr* 2001; 74:1-2.
12. Flood A, Schatzkin A. Colorectal Cancer: Does It Matter if You Eat Your Fruits and Vegetables. *Journal of the National Cancer Institute* 2000; 92:1706-7.
13. Zielinski Sarah L. Eating Fruits and Vegetables Associated With Reduction in Cardiovascular Disease, But Not Cancer. *Journal of the National Cancer Institute* 2004; 96:1563.

Appendix C

Introduction to the Massachusetts Fruit & Vegetable Nutrition Council

The Massachusetts Fruit & Vegetable Nutrition Council is a collaborative of individuals representing public and private organizations. Formally known as the Five A Day Coalition, it was established in 1988 with a common vision of increasing fruit and vegetable consumption of the Massachusetts population as a way to promote health and prevent chronic disease.

The **vision** of the Massachusetts Fruit & Vegetable Nutrition Council is that everyone living in Massachusetts will have access to affordable, high quality fruits and vegetables.

The **mission** of the Massachusetts Fruit & Vegetable Nutrition Council is to increase awareness and educate and affect policy change to increase availability of affordable, quality fruits & vegetables.

Members of the MA Fruit & Vegetable Nutrition Council

ABCD Headstart
American Cancer Society
American Heart Association
Beth Israel-Deaconess Medical Center
BOND of Color
Boston Commission on the Elderly
Boston Public Health Commission
Boston Public Schools
Boston STEPS
Cambridge Health Department
City of Boston
The Federation of Farmer's Markets
Farm to School
The Food Bank of Western Massachusetts
The Greater Boston Food Bank
Hannaford's
Harvard School of Public Health
HESSCO Elder Services
Institute for Community Health
Lane Printing
MA Department of Agricultural Resources
MA Department of Education
MA Department of Public Health
MA Medical Society
New England Dairy Council
Office of Elder Affairs
Operation Frontline
Project Bread
Shaw's Supermarket
Smokey the Wellness Guy
Stop & Shop Supermarket
Tufts University
USDA
UMass Extension
WIC

Date_____

Name of Agency: _____
Zip code of agency: _____

Benefits of Adequate Fruit and Vegetable Intake: An Annotated Bibliography

The Massachusetts Fruit and Vegetable Nutrition Council would like to evaluate your use of the enclosed evidence-based annotated bibliography on fruit and vegetables. This tool was developed to give community based providers up to date information on evidence- based research on the benefits of fruit and vegetable consumption and its relationship to health. These studies demonstrate the role of fruits and vegetables in helping to prevent certain chronic illnesses. Please complete this brief survey. Your input will inform future program decisions. Also please contact the Council with any suggested changes which will enhance the usefulness of this resource packet. Thank you.

1. **Please check the box that best describes your profession:**
   ❑ Health Educator ❑Teacher ❑Primary Care Provider
   ❑ Other (please list) _____

2. **Please check the box that best describes your setting:**
   ❑Health Center ❑WIC ❑School ❑Physician Office ❑Worksite ❑Council on Aging
   ❑Other (please list)_____

3. **Do you think that you will use any of the information in this promotional packet?**
   ❑Yes ❑No ❑Unsure ❑Not applicable

4. **How do anticipate you/your staff will use the materials?**
   ❑ For patient education
   ❑ For local print media
   ❑ For community health fair
   ❑ For worksite wellness
   ❑ Other (please list) _____

5. **Which of the following subject areas would you like more information about to help educate yourself and/or your clients? (Check all that apply)**
   ❑ The *More Matters* campaign
   ❑ Making fruits & veggies more available at home
   ❑ Increasing access to fruits & veggies in school
   ❑ Increasing access to fruits & veggies in the community
   ❑ How to buy fruits & veggies while keeping cost low
   ❑ Model fruit & veggie programs throughout Massachusetts
   ❑ Other (please list) _____
   ❑ Not applicable (explain) _____

6. **In what format would you prefer to receive information about fruits and vegetables? (Check only one)**
   ❑Hard copy ❑Web site ❑CD ❑Other (please list) _____

7. **If you have any additional comments or suggestions, please describe below.**

_____

_____

_____

_____

Thank you.

Please return completed evaluation form by one of these 3 ways:
Email: Cynthia.Bayerl@state.ma.uor
Fax: 617-624-5439
Mail: Cynthia Bayerl, Coordinator Massachusetts Fruit & Vegetable Nutrition Council
Massachusetts Department of Public Health
250 Washington Street 4th Floor
Boston, MA 02108
If you have any question please call Cynthia at 617-624-5439.

Members of the MA Fruit & Vegetable Nutrition

ABCD Headstart
American Cancer Society
American Heart Association
Beth Israel-Deaconess
BOND of Color
Boston Commission on the Elderly
Boston Public Health Commission
Boston Public Schools
Boston STEPS
Cambridge Health Department
City of Boston
The Federation of Farmer's Markets
Farm to School
The Food Bank of Western Massachusetts
The Greater Boston Food Bank
Hannaford's
Harvard School of Public Health
HESSCO Elder Services
Institute for Community Health
Lane Printing
MA Department of Agricultural Resources
MA Department of Education
MA Department of Public Health
MA Medical Society
New England Dairy Council
Office of Elder Affairs
Operation Frontline
Project Bread
Smokey the Wellness Guy
Stop & Shop Supermarket
Tufts University
USDA
UMass Extension
WIC